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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/526,258	09/12/2005	Alastair Dent	53037-7007	7061

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EXAMINER

PILKINGTON, JAMES

ART UNIT	PAPER NUMBER
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3656

NOTIFICATION DATE	DELIVERY MODE
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04/13/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/526,258	Applicant(s) DENT, ALASTAIR	
	Examiner JAMES PILKINGTON	Art Unit 3656	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 March 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,5-10,15-18,24 and 25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,5-10,15-18,24 and 25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 March 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 8, 9, 15-17, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris, WO 02/060653, in view of Akin, USP 4,565,104.

Harris discloses a back-drivable surgical robot head comprising:

- a frame (6)
- an arm (12) for carrying a tool (14) the position of which is to be controlled;
- a manually-graspable driving member (16) on said arm (12);
- a first rotation control mechanism (20) for rotating the arm about a first axis (A1) with respect to said frame (6)
- the first rotation control mechanism (28) comprising a first rotational motor (30)
- in which the first motor (30) is mounted for pivotal motion with respect to a frame of the head
- said head being back-drivable wherein manual forces applied to said driving member (16) by a user grasping said driving member (16) cause said arm (12) to rotate to a desired position, said motor (30) responding to said manual forces to ensure that said arm moves smoothly to said

Art Unit: 3656

position with constant low resistance in an unconstrained region (RI) and with increasing resistance towards a constraint boundary (increasing resistance in RII, see the graph in figure 3 and pages 9-11 which discusses the boundary control and increasing stiffness/resistance)

- a second rotation control mechanism (20) for rotating the arm about a second axis (A1), the said mechanism comprising a second rotational motor (2)
- the first axis (A2) is perpendicular to the second axis (A1)
- the arm (12) is extendible along a third axis (A3)
- in which the first (A2), second (A1) and third axes (A3) intersect at a point
- a force sensor (18) for sensing forces applied to the driving member (16) by a user;
- wherein the first rotational control mechanism (28) is arranged to rotate the arm about the first axis in response to the sensed forces.

Harris does not disclose that the rotation control mechanisms comprising a lead screw having a rotational motor at one end and said lead screw and motor being mounted at said one end to pivot with respect to a frame and a bearing which moves longitudinally of the lead screw as it rotates, the bearing being pivotally coupled to an offset crank of or secured to the arm.

Akin teaches rotation control mechanisms comprising a motor (29), a lead screw (24) wherein the motor (29) and the lead screw (24) are mounted at said one end to pivot with respect to a frame (12 pivots about 15 which is secured to an exterior frame) and a

Art Unit: 3656

bearing (37) which moves longitudinally of the lead screw (24) as it rotates, the bearing being pivotally coupled to an offset crank (32) of or secured to an arm (34/35) for the purpose of providing a linear actuator to rotate a load that minimizes loss of moment arm at the extremes of rotational travel of the load.

It would have been obvious to one having ordinary skill in the art to modify Harris and provide a first and second rotation control mechanism that comprises a lead screw and a bearing which moves longitudinally of the lead screw as it rotates, and motor being mounted at said one end to pivot with respect to a frame, the bearing being pivotally coupled to an offset crank of or secured to the arm, the lead screw has a high lead angle, resulting in the lead screw being mounted for pivotal motion with respect to a frame of the head, as taught by Akin, for the purpose of providing a linear actuator to rotate a load that minimizes loss of moment arm at the extremes of rotational travel of the load. In additional substituting one transmission mechanism for another would have been obvious to one having ordinary skill in the art. The combination would result in a device which would operate with a lead screw which would pivot between a zero position and a maximum pivot position relative to the frame when a applied force is sensed.

Claims 3 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris, WO 02/060653, in view of Akin, USP 4,565,104 and further in view of Yamanaka, USP 4,825,714.

Art Unit: 3656

Harris in view of Akin discloses all of the claimed subject matter discussed above.

Akin does not disclose that the motor is directly secured to the lead screw, without any intervening gears.

Yamanaka teaches a lead screw drive arrangement wherein the motor (11) is directly secured to the lead screw (15), without any intervening gears.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to substitute the motor spindle arrangement of Akin with the direct drive system of Yamanaka, for the predictable result of removing play/backlash that is found between intervening gears.

Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris, WO 02/060653, in view of Akin, USP 4,565,104 and further in view of Zufle, US PGPub 2003/0109953.

Harris in view of Akin discloses all of the subject mater as discussed above.

Harris does not disclose a first sensor for measuring the position of the arm and a second sensor for measuring the rotation of the motor and sounding an alarm if there is an inconsistency.

Zufle teaches a detection system which uses a first sensor for measuring the position of an arm/movement member (detector 5) and a second sensor for measuring the rotation of the motor (paragraph 0025) and sounding an alarm if there is an inconsistency (sets down drive 3 or paragraph 0017) for the purpose of providing a

Art Unit: 3656

direct and indirect detection method to ensure movement of the arm is correct (paragraph 0015 and 0025).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Harris and provide a first sensor for measuring the position of the arm and a second sensor for measuring the rotation of the motor and sounding an alarm if there is an inconsistency, as taught by Zufle, for the purpose of providing a direct and indirect detection method to ensure movement of the arm is correct.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Harris, WO 02/060653, in view of Akin, USP 4,565,104 and further in view of Zimmerman, USP 6,494,005.

Harris in view of Akin discloses all of the subject matter as discussed above.

Harris does not disclose that the arm is extendible on a third lead screw which is rotated by a third rotational motor.

Zimmerman teaches an arm (12) extendable on a lead screw (50) which is rotated by a motor (30) for the purpose of concealing the motor within an arm segment (C1/L45-52) which in turn reduces the size of the device.

It would have been obvious to one having ordinary skill in the art to replace the rack and pinion drive system of Harris with a third lead screw which is rotated by a third rotational motor, as taught by Zimmerman, for the purpose of concealing the motor within an arm segment which in turn reduces the size of the device.

Response to Arguments

Applicant's arguments filed March 15, 2010 have been fully considered but they are not persuasive.

The Applicant argues that the linear actuator of Akin is not back drivable and thus the combination not proper.

Any linear screw and nut system, as in the Akin reference and the instant application, is back drivable regardless of the thread pitch. The claim does not recite any specific back drivable structure and a screw and nut system can be driven in reverse, either by hand or a motor. In the case of Akin the device is attached to a motor which can be run in forwards and reverse thus making the system back drivable.

The Applicant has also provided supporting evidence for a meaning of "back-drivability." However, the combination of Harris and Akin results in a device which meets this definition; this "back-drivability" feature is found in the primary reference to Harris and is the same as that of the instant application. The replacement of the drive system of Harris with that of Akin does not alter the operation of the device of Harris and results in a back drivable device. In addition, the specification as originally filed did not limit "back-drivable" to mean that the device has the ability to switch the input with the output. The specification, in paragraph 0039, defined back drivable as a response to a pull from the surgeon and does not limit the arrangement to one where the force of the user rotates the shaft directly. The arrangement of Akin responds to a pull from the

Art Unit: 3656

surgeon, through a system of sensors and motors, and therefore meets the constraints of the term "back-drivable" as originally set forth by the Applicant.

Also, the supporting documentation provided by the Applicant relates to Anthropomorphic Robot Hands, not a surgical robot arm operated by a user. The backdrivability discussed in this document is concerned with providing flexibility to the system not a backwards driving force. Outside the section underlined by the Applicant the introduction of the document states that "backdrivability plays a large role in actuator flexibility and force controllability" and "without backdrivability, actuators had to realize flexibility by either adding elastic components in series to the actuator output, or by control." The document later goes on to state that the backdrivability/flexibility "of the actuation is especially effective in grasping and manipulating of the objects. Since grasping involves multiple point contacts with uncertainty, robot hands need to deal with uncertain complicated force interaction", in other words backdrivability, in the case of this document, is the ability of an actuator to adjust to the object being worked upon (i.e. the robotic hand won't crush the object it is handling). Since this document is clearly relating to the movement of robot hands and not the movement of an arm in response to a user it appears that this definition is not analogous to the instant application.

Regarding the Applicant's arguments directed toward the newly added language.

Harris discloses that the resistance to the users input is changed as the arm gets closer to a boundary. Harris discusses this on pages 9-11 of the disclosure.

Art Unit: 3656

With regards to the Applicant's comments about in the Mechanical Arrangement of Akin section of the remark the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). That fact that Akin deals with a large angle of rotation and is not a surgical robotic device does not mean that one of ordinary skill in the art would not look to the disclosure of Akin and appreciate that the same motion transmitting arrangement (linear to rotary) can be used in other environments and within limited operation ranges. Modifications to fit a particular operation range for a particular environment are within the level of ordinary skill in the art.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 3656

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES PILKINGTON whose telephone number is (571)272-5052. The examiner can normally be reached on Monday - Friday 7-3.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Ridley can be reached on (571)272-6917. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JAMES PILKINGTON/
Examiner, Art Unit 3656
4/8/10

/Thomas R. Hannon/

Primary Examiner, Art Unit 3656